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NATIONAL DAM SAFETY PROGRAM. LAKE BRITTLE DAM (VA-06122), POTOM--ETC(U)
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POTOMAC RIVER BASIN

AD A075309

LEVEL II

Name Of Dam: LAKE BRITTLE DAM
Location: FAUQUIER COUNTY
Inventory Number: 06122

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

PREPARED BY
NORFOLK DISTRICT CORPS OF ENGINEERS
803 FRONT STREET
NORFOLK, VIRGINIA 23510

SEPTEMBER 1979

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REPORT DOCUMENTATION PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER: VA 06122	2. GOVT ACCESSION NO. / 3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle): Phase I Inspection Report National Dam Safety Program LAKE BRITTLE DAM Fauquier County, VA	5. TYPE OF REPORT & PERIOD COVERED: Final 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s): Norfolk District Corps of Engineers 803 Front Street Norfolk, Va 23510	8. CONTRACT OR GRANT NUMBER(s): (9) Final rept., None
9. PERFORMING ORGANIZATION NAME AND ADDRESS	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS: (12) 68
11. CONTROLLING OFFICE NAME AND ADDRESS: U. S. Army Engineering District, Norfolk 803 Front Street Norfolk, VA 23510	(11) 12. REPORT DATE: September 1979 13. NUMBER OF PAGES
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office): (10) James A. Walsh	15. SECURITY CLASS. (of this report): Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

(6) National Dam Safety Program. Lake Brittle Dam (VA-06122), Potomac River Basin, Fauquier County, Virginia. Phase I Inspection Report.

18. SUPPLEMENTARY NOTES

Copies are obtainable from National Technical Information Service, Springfield, Virginia 22151

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dams - VA
National Dam Safety Program Phase I
Dam Safety
Dam Inspection

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

(See reverse side)

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Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

20. Abstract

Pursuant to Public Law 92-367, Phase I Inspection Reports are prepared under guidance contained in the recommended guidelines for safety inspection of dams, published by the Office of Chief of Engineers, Washington, D. C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general conditions of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

Based upon the field conditions at the time of the field inspection and all available engineering data, the Phase I report addresses the hydraulic, hydrologic, geologic, geotechnic, and structural aspects of the dam. The engineering techniques employed give a reasonably accurate assessment of the conditions of the dam. It should be realized that certain engineering aspects cannot be fully analyzed during a Phase I inspection. Assessment and remedial measures in the report include the requirements of additional indepth study when necessary.

Phase I reports include project information of the dam and appurtenances, all existing engineering data, operational procedures, hydraulic/hydrologic data of the watershed, dam stability, visual inspection report and an assessment including required remedial measures.

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of the Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (flood discharges that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the design flood should not be interpreted as necessarily posing a highly inadequate condition. The design flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

NAME OF DAM: LAKE BRITTLE DAM

LOCATION: FAUQUIER COUNTY, VIRGINIA

INVENTORY NO. VA 06122

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

PREPARED BY
NORFOLK DISTRICT, CORPS OF ENGINEERS
803 FRONT STREET
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PHASE I REPORT

NATIONAL DAM SAFETY PROGRAM

BRIEF ASSESSMENT

Name of Dam:	Lake Brittle Dam
State:	Virginia
County:	Fauquier
USGS Quad Sheet:	Thoroughfare Gap
Stream:	South Run
Date of Inspection:	30 May 1979

Lake Brittle Dam is an earthfill structure about 1200 feet long and 32.5 feet high. The dam is owned and operated by the Virginia Commission of Game and Inland Fisheries. The dam is classified as an intermediate size with a significant hazard classification. The principal spillway consists of a 36-inch reinforced concrete pipe, served by a drop-inlet located in the reservoir. The ungated spillway located at the left abutment is an open channel earthen spillway with a concrete weir at its crest. The emergency spillway located at the right abutment is an open channel earthen spillway. The dam is located about 0.4 miles west of Vint Hill Farms Station Military Reservation.

Based on criteria established by the Department of the Army, Office of the Chief of Engineers (OCE), the Spillway Design Flood (SDF) is the 1/2 PMF. The ungated spillway and the emergency spillway will pass 35 percent of the PMF without overtopping the dam; therefore, the ungated spillway and emergency spillway are adjudged as inadequate. The visual inspection revealed no apparent problems and the dam is considered stable for maximum pool operations. There is no immediate need for remedial measures. However, an annual maintenance and inspection program should be initiated within 12 months. The program should correct the items mentioned in Section 7.2.

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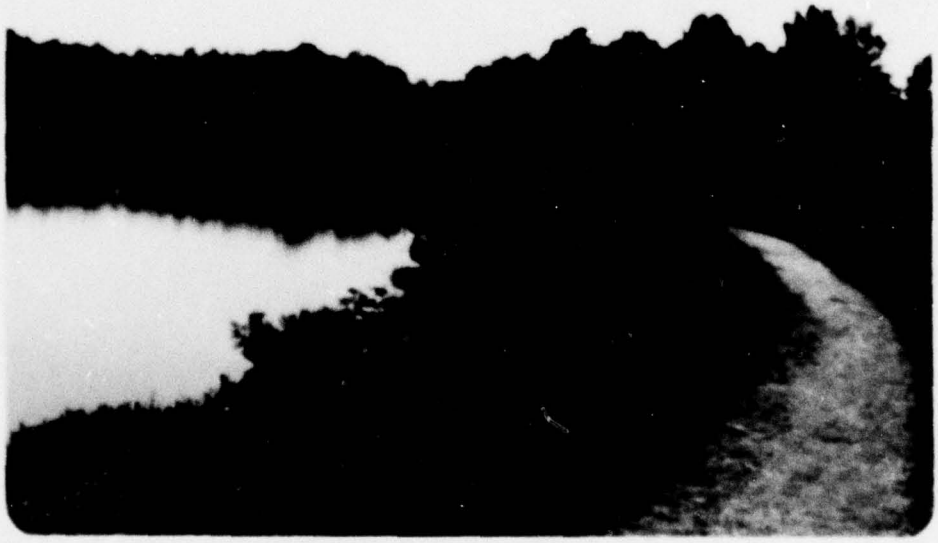
SEP 12 1979
DATE

CREST



UPSTREAM SLOPE

OVERALL VIEWS OF DAM

31 MAY, 1979

SECTION 1
PROJECT INFORMATION

1.1 General:

1.1.1 Authority: Public Law 92-367, 8 August 1972, authorized the Secretary of the Army, through the Corps of Engineers to initiate a national program of safety inspections of dams throughout the United States. The Norfolk District has been assigned the responsibility of supervising the inspection of dams in the Commonwealth of Virginia.

1.1.2 Purpose of Inspection: The purpose is to conduct a Phase I inspection according to the Recommended Guidelines for Safety Inspection of Dams (See Reference 3, Appendix VI). The main responsibility is to expeditiously identify those dams which may be a potential hazard to human life or property.

1.2 Project Description:

1.2.1 Dam and Appurtenances: Lake Brittle Dam is an earth embankment dam about 1200 feet long and 32.5 feet high. The embankment is a homogeneous structure keyed into a "solid" material foundation with no drainage system. The top of the dam is 14 feet wide at an elevation 132.5 feet assumed datum*. The upstream slope has a 1 vertical to 3 horizontal (1:3) slope and the downstream slope is (1:2.5).

The principal spillway consists of a 36-inch reinforced concrete pipe, running through the dam at a low level. The pipe is served by a drop-inlet structure located in the reservoir with a crest at elevation 127.0. One side of the drop-inlet is comprised of two 2 x 12-inch timber stoplogs placed on top of each other. These boards must be removed to lower the reservoir below normal pool. The discharge outlet is partially submerged due to the pool level in the stilling basin.

The ungated spillway is an open channel earthen spillway at the left abutment. It has a bottom width of about 150 feet with a 2-foot wide concrete weir crest at elevation 127.5 feet*. The approach channel slopes slightly for 150 feet and the discharge channel slopes down the left abutment to the downstream channel.

The emergency spillway is an earthen side-channel spillway located at the right abutment. It has a bottom width of about 50 feet with the crest at elevation 128.0*. The approach and discharge channel slope slightly with the discharge channel discharging into the woods below the dam and then to the downstream channel.

1.2.2 Location: Lake Brittle Dam is located on South Run about 0.4 miles west of Vint Hill Farms Station Military Reservation.

1.2.3 Size Classification: The dam is classified as an "intermediate" size structure because of the storage volume at the top of dam (1300 acre-feet).

1.2.4 Hazard Classification: The dam is located in a rural area above Vint Hill Farms Station Military Reservation and is therefore given a significant hazard classification in accordance with guidelines of Reference 3, Appendix VI. The hazard classification used to categorize dams is a function of location only and has nothing to do with its stability or probability of failure.

1.2.5 Ownership: Virginia Games and Inland Fisheries

1.2.6 Purpose: Recreation

1.2.7 Design and Construction History: The dam was designed by Perrow & Brockenbrough Consulting Engineers and constructed in 1954 by R. L. Rider & Co.

1.2.8 Normal Operational Procedures: Water flows automatically over the drop-inlet to the principal spillway outlet as the reservoir pool rises above elevation 127'. Flows pass automatically through the ungated and emergency spillway as the pool rises above the crest of each spillway.

1.3 Pertinent Data:

1.3.1 Drainage Areas: The dam controls a drainage area of 4.79 square miles.

1.3.2 Discharge at Dam Site:

Maximum known flood - During Tropical Storm Agnes in 1972 the pool reached approximately elevation 130.5'. The discharge was approximately 2667 cfs.

Ungated spillway
Pool level at top of dam . . . . . 4528 c.f.s.

Emergency Spillway:
Pool level at top of dam . . . . . 1360 c.f.s.

1.3.3 Dam and Reservoir Data: Pertinent data on the dam and reservoir are shown in the following table:

Table 1.1 DAM AND RESERVOIR DATA

Item	Elevation feet*	Reservoir Capacity Area acres	Reservoir Capacity Acre feet	Reservoir Capacity Watershed inches	Length miles
Top of dam	132.5	116	1300	5.09	0.8
Emergency spillway crest	128.0	83	820	3.21	0.7
Ungated spillway crest	127.5	80	780	3.05	0.7
Principal spillway crest(a)	127.0	77	735	2.88	0.7
Streambed	100±				

* The USGS QUAD SHEET Thoroughfare Gap list the normal pool at 401.0 feet mean sea level. All elevations are referenced to those on the drawings provided by the owner which are not mean sea level.

(a) Normal Pool

SECTION 2

ENGINEERING DATA

2.1 Design: Design data were provided by the owners. The data reviewed included the following:

a. Complete 1954 contract documents which include drawings (Appendix I, Plates I, II, and III) and specifications (Appendix V). The documents were prepared by Perrow & Brockenbrough, Consulting Engineers, Richmond, Virginia. The contract documents show plans and cross sections of the embankment and appurtenant structures. The specifications outline the required construction procedures and material requirements.

b. A 1955 contract drawing by Perrow & Brockenbrough for the construction of an access road to the dam. The drawing also includes repair and riprapping of the upstream slope of the dam embankment (Appendix I, Plate IV).

c. A 1973 boundary survey of property on the reservoir shoreline showing nearest available survey monuments.

The contract documents show that the dam was professionally designed. The embankment is a homogeneous structure keyed into a "solid" material foundation with no drainage system. Fill was placed in 6-inch lifts and compacted with a sheeps-foot roller having a unit contact pressure of 200 pounds per square inch. The required density was 95 percent of maximum density at optimum moisture, but no test procedure was noted. Borrow areas are shown on the drawings, and the specifications require clean clay for fill. A wooden barrier wall is located at the center of the embankment at the waterline to prevent animals from burrowing throught the dam.

There are no design studies, reports, or calculations available. There are no references to hydrologic, hydraulic, or geologic reports. Borings are referenced in the specifications, but locations are not shown on the drawings and no logs are available. There are no other known field investigations. There are no records of laboratory testing.

2.2 Construction: There are no available construction records.

2.3 Evaluation: The contract drawings adequately present the embankment and appurtenant structures. The drawings were reported by the owners to be as-built documents, but there is nothing on the drawings indicating them as as-built documents. The contract specifications adequately outline the required construction measures and material requirements.

There are no construction records to verify compliance with the specifications. Also, there are no design records to determine the nature of the structure. However, the contract documents indicate that the dam was designed under the direction of professional attention.

SECTION 3

VISUAL INSPECTION

3.1 Findings:

3.1.1 General: The results of the 31 May 1979 inspection are recorded in Appendix III. At the time of the inspection the pool elevation was at 127.0', or about normal pool elevation. There was no regulating equipment on the outlet works, and a 36-inch principal spillway outlet was half submerged by the pool level in the stilling basin. The only previously known inspection was a 1972 visual inspection report with recommendations by Froehling & Robertson, Inc., Richmond, Virginia. This report indicated the embankment and spillways were overgrown with brush and locust, and the embankment was infested with moles. Also, the upstream slope had developed a wave-cut bench with a shallow ripline extending the full length of the dam. Recommendations included removing vegetation, riprapping the upstream slope, and instituting a regular inspection and maintenance program. According to John Banister, the embankment and spillway were trimmed of vegetation, but no riprap was installed nor was a regular inspection and maintenance program instituted.

3.1.2. Dam: The embankment was in fair condition. However, the upstream slope had experienced erosion along the shoreline. It also had little to no vegetative cover. Existing riprapped slope protection had deteriorated. Also, it was noted that the upstream slope had been subjected to a 3 to 4-foot drawdown from normal pool without any detrimental effect to the slope. The crest of the dam served as a foot path. See the overall photographs in the front of the report. The downstream slope was thickly vegetated with brush and locust saplings except for surface erosion that had exposed most of the slope in an area about 150 feet right of the principal spillway, Appendix II, Photo 6 and 4, respectively. A linear wet spot was located in the embankment about 125 feet right of the spillway. Several wet spots with local ponding were located in the downstream area, Appendix II, Photo 5. The embankment seep and the general downstream seepage area are shown on Plate I, Appendix I. However, no sloughing, settlement or misalignment were noted.

3.1.3 Appurtenant Structures: Observations of the intake structure showed deterioration. However, most of the structure was submerged at the time of the inspection, Appendix II, Photo 1. The principal spillway and discharge channel appeared to be in good condition and showed no signs of deterioration, Appendix II, Photo 2.

3.1.4 Ungated and Emergency Spillway: The ungated spillway was in good condition except for some sparse areas of grass cover, Appendix II, Photo 8. Also, there was heavy vegetation in the lower end of the discharge channel that would obstruct flow. The emergency spillway had a small erosion gully in the upper portion of the discharge channel. Also, there was heavy vegetation in the lower portion of the channel, Appendix II, Photo 7.

3.1.5 Instrumentation: There was no instrumentation on the dam other than a concrete weir across the ungated spillway.

3.1.6 Reservoir Area: The surrounding area had gently rolling terrain, half wooded and half pastureland. There were no signs of shoreline erosion or apparent slope failures. There was no available information pertaining to sedimentation.

3.1.7 Downstream Channel: The downstream area was thick with the growth in the channel and overbank for at least one-quarter mile downstream, Appendix II, Photo 3. Portions of Vint Hill Farms Station Military Reservation lie about one-half mile below the dam. The channel below the stilling basin was shallow (less than 2 feet) and about 15 feet wide.

3.2 Evaluation: Overall, the dam appeared to be in fair condition. There are no problems that require immediate remedial measures. However, the inspection revealed certain items which should be scheduled as part of an annual maintenance program. These are:

a. Trim all brush and locust located on the embankment.

b. Repair the small erosion gully in the upper portion of the discharge channel of the emergency spillway.

c. Provide a paved foot path across the crest of the dam. This will still allow access along the dam and protect the crest from erosion.

d. Provide a vegetative cover (grass) for all exposed areas on the dam, particularly the upstream slope. Additional slope protection is not considered necessary, because of very little wave action and non-fluctuating pool levels.

e. Provide a staff gage on the intake structure to extend above the normal pool elevation.

f. Monitor periodically the wet spot located in the downstream slope to detect seepage, particularly during high water levels. Also monitor the wet spots in the downstream area. If seepage should develop on the slope, or the downstream wet spots should become muddy, the services of a qualified geotechnical engineering firm should be retained to consider immediate remedial measures.

g. Clear the trees in the emergency spillway discharge channel to allow unobstructed flow to the creek in the downstream area. The trees could direct flow toward the toe of the downstream embankment and encourage erosion. It is not considered necessary to clear the trees in the ungated spillway, because obstructed flows will likely be directed away from the embankment.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedures: Lake Brittle Dam is used for recreation. The normal pool elevation is maintained by a drop-inlet serving the principal spillway. When the pool rises above the crest of the drop-inlet, water automatically passes through the principal spillway. During extreme flood periods, the pool may rise above the ungated spillway crest and the emergency spillway crest causing flow to automatically pass downstream. Wooden stoplogs must be removed from the drop-inlet to dewater the lake.

4.2 Maintenance: A routine maintenance program has not been established for Lake Brittle Dam, although periodic maintenance has occurred. Stoplogs are replaced when needed and the surrounding area is cleaned of trash and debris weekly.

4.3 Warning System: At the present time, there is no warning system or evacuation plan in operation.

4.4 Evaluation: The dam does not require an elaborate operational and maintenance procedure. However, the annual maintenance and inspection program should be initiated to help detect and control problems that may occur.

SECTION 5
HYDRAULIC/HYDROLOGIC DESIGN

5.1 Design: Partial design information is on file at the owner's office.

5.2 Hydrologic Records: Rainfall records are available at the owner's office. The peak 24-hour recorded rainfall occurred during Tropical Storm Agnes on 22 June 1972 (10.12 inches). Air and water temperature and rainfall values are recorded at 7:00 AM each morning by a representative that resides at the lake.

5.3 Flood Experience: The maximum flood reached was approximately elevation 130.5 or about 2 feet below the top of the dam, during Tropical Storm Agnes in June 1972.

5.4 Flood Potential: The PMF and 1/2 PMF were developed and routed through the reservoir by use of the HEC-1DB computer program (Reference 1, Appendix VI) and appropriate unit hydrograph, precipitation, and storage-outflow data. Clark's Tc and R coefficients for the local drainage area were estimated from basin characteristics. The rainfall applied to the developed unit hydrograph was obtained from a U. S. Weather Bureau Publication (Reference 2, Appendix VI). Losses were estimated at an initial loss of 1.0 inch and a constant loss thereafter of 0.05 inch/hour.

5.5 Reservoir Regulation: Pertinent dam and reservoir data are shown in table 1.1.

Regulation of flow from the reservoir is automatic with flow occurring as the pool rises above elevation 127.0*. The 36-inch principal spillway allows flow to pass through the dam. Flow passes the dam though the ungated spillway and emergency spillway as the pool elevation rises above elevation 127.5* and 128.0*, respectively.

The storage curve was developed from a contour map of the lake furnished by the owner and the U.S. Geological Survey Quadrangle Map. Rating curves were developed for the principal spillway, ungated spillway, emergency spillway, non-overflow section of the right abutment. In routing hydrographs through the reservoir, it was assumed that the initial pool level was at the principal spillway crest. Flow through the principal spillway was not used in the routings.

5.6 Overtopping Potential: The probable rise in the reservoir and other pertinent information on reservoir performance is shown in the following table:

Table 5.1 RESERVOIR PERFORMANCE

Item	Normal Flow	Hydrograph ½ PMF	Hydrograph PMF 1/
Peak flow, c.f.s.			
Inflow	5	10626	21252
Outflow	5	10470	21198
Maximum elevation ft,*	127.0	133.1*	134.4*
Ungated Spillway (el. 127.5*)			
Depth of flow, ft.		5.6	6.9
Duration, hrs.		20	20
Velocity, f.p.s.2/		10.5	11.6
Emergency Spillway (el. 128.0*)			
Depth of flow, ft.		5.1	6.4
Duration, hrs.		14	16
Velocity, f.p.s.2/		10.2	11.4
Non-overflow section (el. 132.5*)			
Depth of flow, ft.		0.6	1.9
Duration, hrs		2.5	5
Velocity, f.p.s.2/		3.6	6.3
Tailwater elevation ft., *	100±		

1/ The PMF is an estimate of flood discharges that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region.

2/ Critical velocity.

5.7 Reservoir Emptying Potential: The 36-inch reinforced concrete pipe is available for dewatering the reservoir, assuming that the stoplogs in the riser can be removed or broken. The low level opening (bottom boards removed) will permit withdrawal of about 187 cfs with the reservoir level at the crest of the drop-inlet and essentially dewater the reservoir in less than 4 days.

5.8 Evaluation: Based on the size (intermediate) and hazard classification (significant), the recommended spillway design flood is 1/2 PMF to the PMF. Based on the risk involved in this project the SDF is the 1/2 PMF. The ungated spillway and the emergency spillway will pass 35 percent of the PMF without overtopping the dam. The 1/2 PMF will overtop the dam to a maximum 0.6 feet and reach an average critical velocity of 3.6 feet per second.

Conclusions pertain to present day conditions and the effect of future development on the hydrology has not been considered.

SECTION 6
DAM STABILITY

6.1 Foundation and Abutments: The subsurface conditions are unknown other than the general geologic description presented in the 1972 inspection by Froehling & Robertson, Inc., Appendix IV. According to this report, the area is underlain by the Triassic Formation consisting of Bull Run Shale and the Manassas Sandstone. The visual inspection revealed several wet spots in the downstream area within 100 feet of the embankment. There is insufficient information to determine the nature of the seepage.

According to the drawings the dam is keyed into "solid" material, but does not have a foundation drainage system. The specifications did not note any special foundation treatment other than initial placement of fill. Overall, based on the visual inspection the foundation appears stable, but there is insufficient information to adequately determine the foundation conditions.

6.2 Embankment

6.2.1 Material: The specifications required a clean clay free from roots, topsoil and other objectionable materials. The borrow sources were located in the ungated spillway area and pits located north and south of the dam. Based on the geology, the area soils are a fine grained, acidic, residual material.

The embankment was constructed with a barrier wall in the center of the dam as shown on Plate I, Appendix I. A complete description of the wall is provided in the specifications, Section 7, Pages 5-6, Appendix V. Essentially, the wall is a 5-foot wooden barrier with a 2-foot concrete block cap. The purpose of the barrier is to prevent damage to the earth fill by burrowing rodents.

Assuming a straight phreatic surface from design pool elevation 127', the wood is submerged and therefore possibly preserved. However, the area soils are acidic and there is concern as to whether or not the wood has deteriorated, particularly at the waterline. The visual inspection revealed no signs of settlement along the crest of the embankment that would indicate a collapse of subsequent voids due to deteriorated wood within the fill.

The visual inspection did reveal a linear wet spot located on the downstream embankment slope about 125 feet to the right of the principal spillway. The pool elevation was at about 127' and the seepage exited at about elevation 116'. The structure has no drainage system, therefore, seepage on the embankment should be expected. The inspection found no other areas of seepage on the embankment. It is possible the embankment seepage is passing into the foundation and discharging into the several wet spots located in the immediate downstream area.

6.2.2 Stability: There are no stability calculations for any loading conditions on the dam. Based on the drawings, the embankment is 14 feet wide with a 1V:3H upstream slope and 1V:2.5H downstream slope. According to the guidelines outlined in Design of Small Dams, U.S. Department of Interior, Bureau of Reclamation, for homogeneous earthfilled dams on stable foundations, the recommended width for this type dam is 16 feet with slopes of 1V:3H upstream, and 1V:2.5H downstream for clay/silt soils. Based on these guidelines, the width is inadequate, but the slopes are adequate.

The dam has an approximate freeboard of 5 feet. Therefore, the embankment is presently existing at a maximum pool load. Also, it was noted that the upstream slope had been subjected to a 3 to 4-foot drawdown from normal (maximum) pool without any detrimental effect to the slope.

6.2.3 Seismic Stability: The dam is located in Seismic Zone 2. Therefore, according to Reference 3, Appendix VI, the dam is considered to have no hazard from earthquakes provided static stability conditions are satisfactory and conventional safety margins exist.

6.3 Evaluation: There is insufficient design and construction data available to assess the stability of the structure. According to Bureau of Reclamation guidelines, the dam width is inadequate. However, based on the visual inspection and the noted drawdown performance, the embankment appears stable for maximum pool elevation.

Overtopping flows during the spillway design flood which overtop the dam by 0.6 feet with an average critical velocity of 3.6 FPS is not considered detrimental to the dam. The design flood velocity is below the typical permissible velocity of 6.0 fps for vegetated compacted earth dams.

SECTION 7

ASSESSMENT, RECOMMENDATIONS/REMEDIAL MEASURES

7.1 Assessment: Lake Brittle Dam, as observed 31 May 1979, appears stable. Available engineering data were limited to contract drawings and specifications. The visual inspection uncovered no apparent problems that threaten the integrity of the dam. There is no regular maintenance program. There is no regulating equipment on the dam. Reference 3, Appendix VI, recommends a Spillway Design Flood equivalent to the 1/2 PMF to the PMF. Based on the risk involved in this project the SDF is 1/2 PMF. The ungated spillway and the emergency spillway will pass 35 percent of the PMF without overtopping the dam; therefore, the spillways are considered inadequate. Flows overtopping the dam during the SDF are not considered detrimental to the embamkment.

Based on the visual inspection and available information, the embankment is considered stable for maximum pool operations.

7.2 Recommendations/Remedial Measures: There is no immediate need for remedial measures. However, an annual maintenance and inspection program should be initiated within 12 months. The following items are suggested and should be scheduled as part of the first annual program.

a. Trim all brush and locust located on the embankment.

b. Repair the small erosion gully in the upper portion of the discharge channel of the emergency spillway.

c. Provide a paved foot path across the crest of the dam.

d. Provide a vegetative cover (grass) for all exposed areas on the dam, particularly the upstream slope.

e. Provide a staff gage on the intake structure to extend above the normal pool elevation.

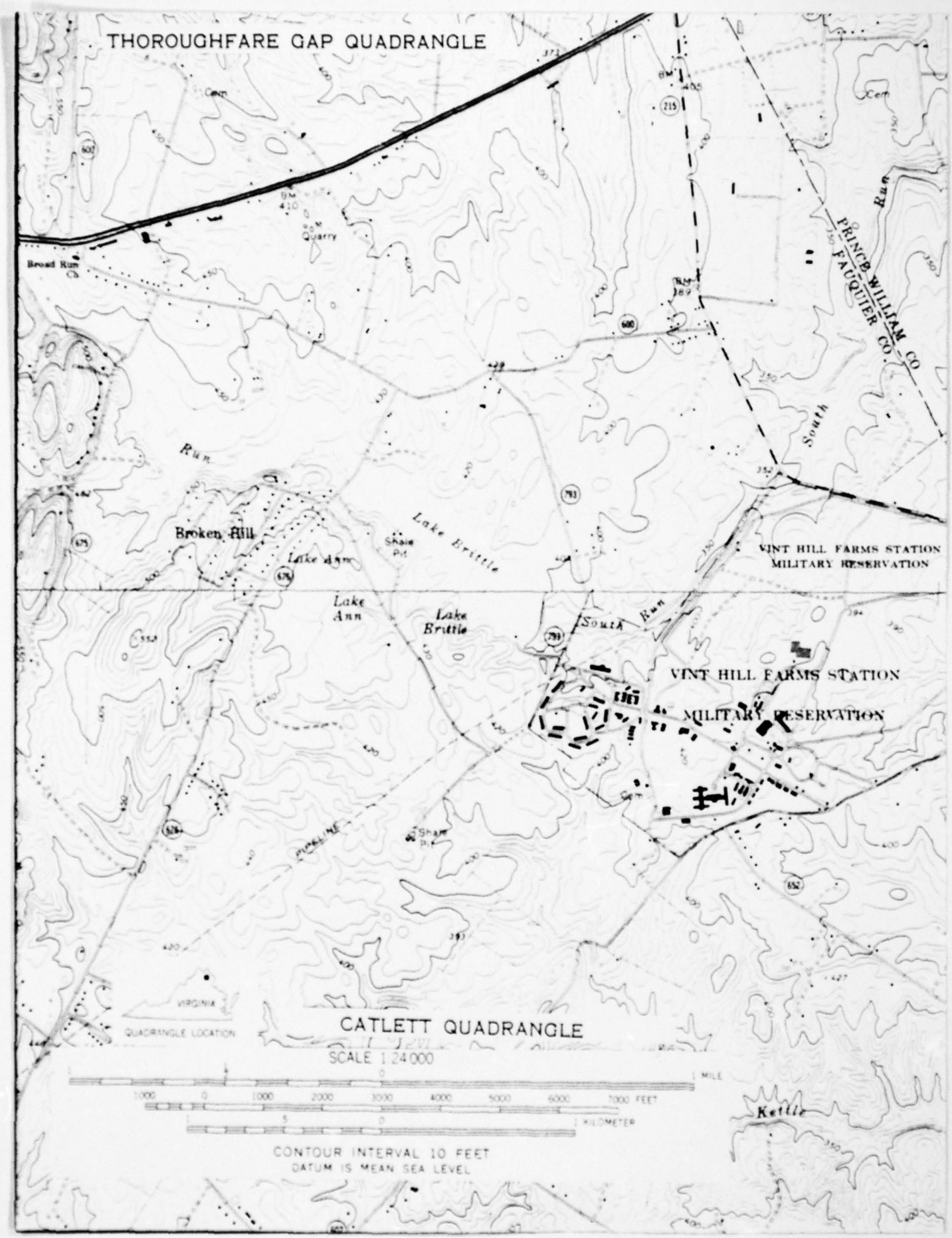
f. Monitor periodically the wet spot located in the downstream slope to detect seepage particularly during high water levels. Also monitor the wet spots in the downstream area. If seepage should develop on the slope, or the downstream wet spots should become muddy, the services of a qualified geotechnical engineering firm should be retained to consider immediate remedial measures.

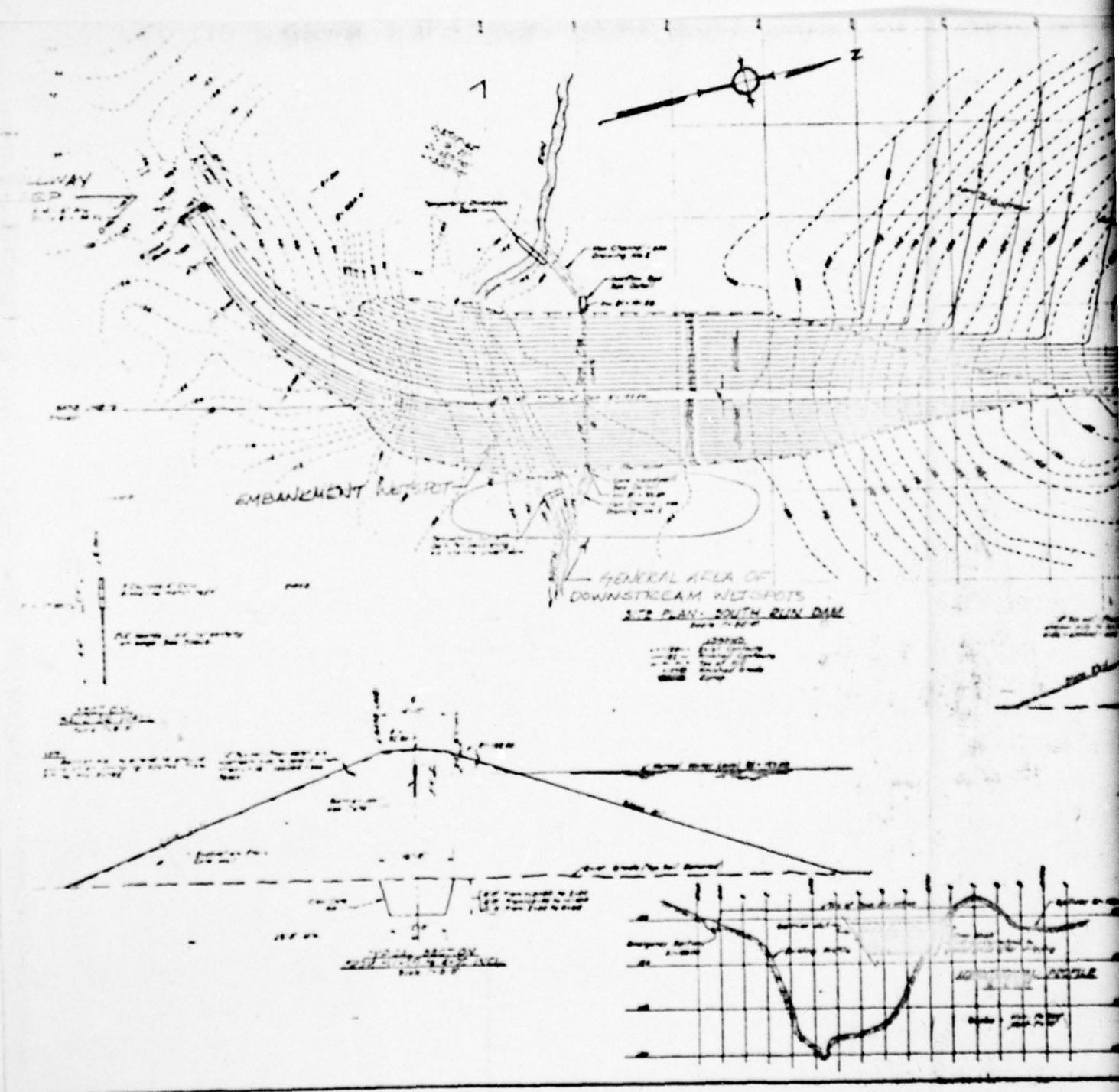
g. Clear the trees in the emergency spillway discharge channel to allow unobstructed flow to the creek in the downstream area.

The owner of the dam is cognizant of the problems that exist, and is making an effort to secure funds to perform the required work. (See Appendix VII)

APPENDIX I

MAPS AND DRAWINGS


THOROUGHFARE GAP QUADRANGLE
Broad Run
Quarry
Run
Broken Hill
Lake dam
Lake Ann
Lake Brittle
Shale Pit
South Run
PRINCE WILLIAM CO.
FAUQUIER CO.
VINT HILL FARMS STATION
MILITARY RESERVATION
VINT HILL FARMS STATION
MILITARY RESERVATION
PIPELINE
Sham Pit
Kettle
VIRGINIA
QUADRANGLE LOCATION
CATLETT QUADRANGLE
SCALE 1:24000
1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 0 1 KILOMETER
CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL


N
EMBANKMENT
GENERAL AREA OF
DOWNSTREAM WELLSPOTS
SITE PLAN: SOUTH RUN DAM

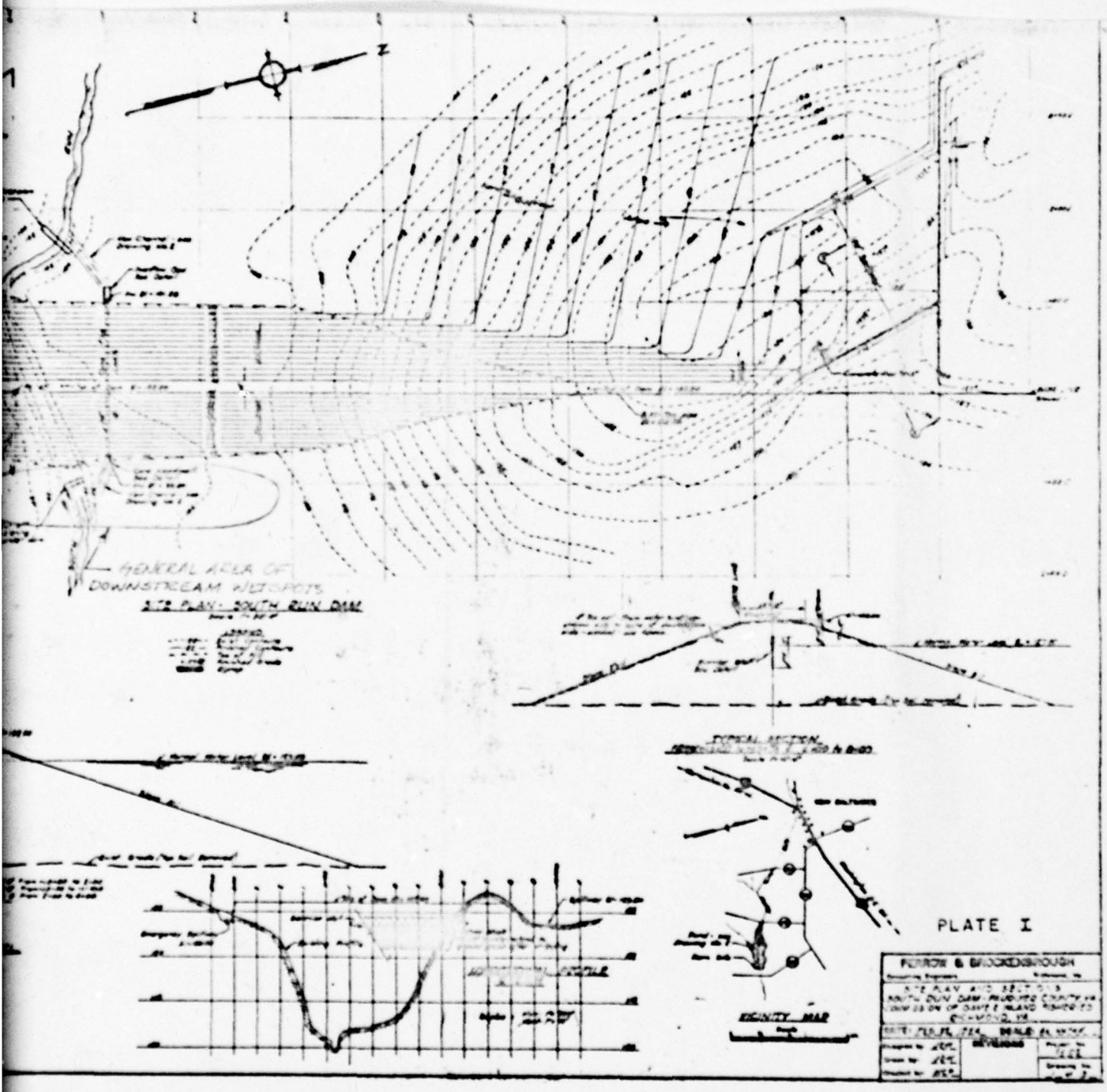
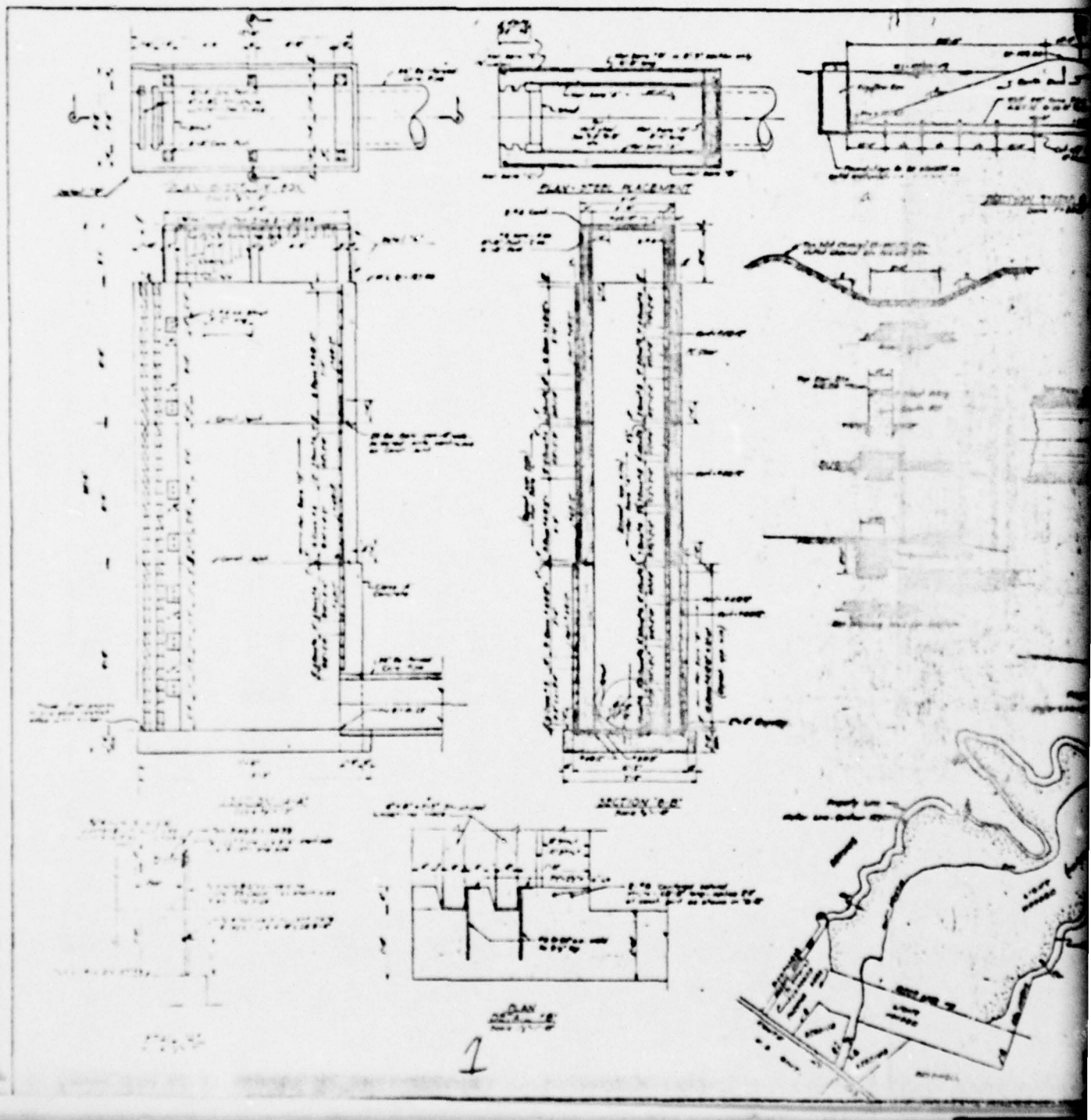


PLATE I

FERROW & BRODKEBROUGH

1 1 2



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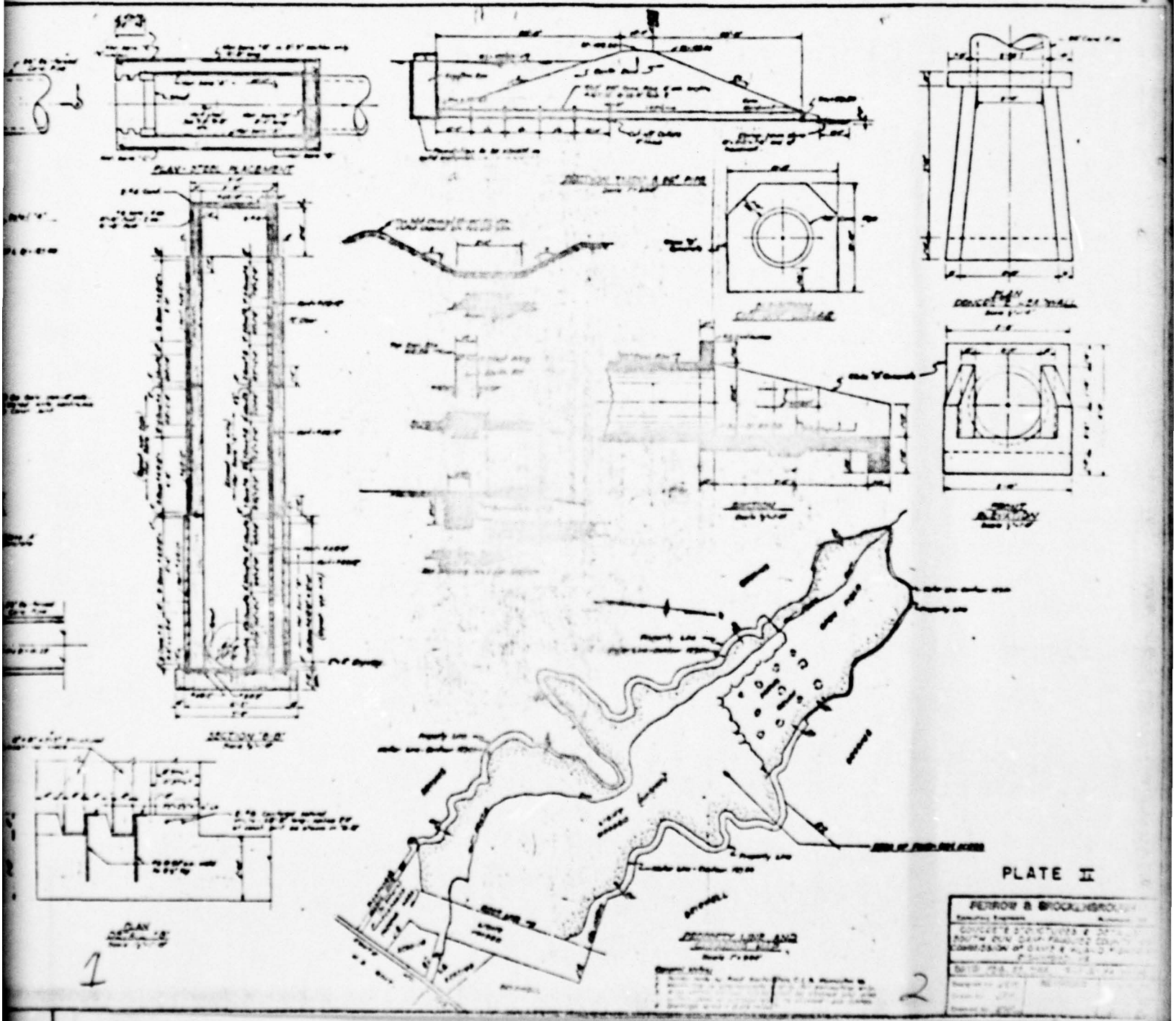
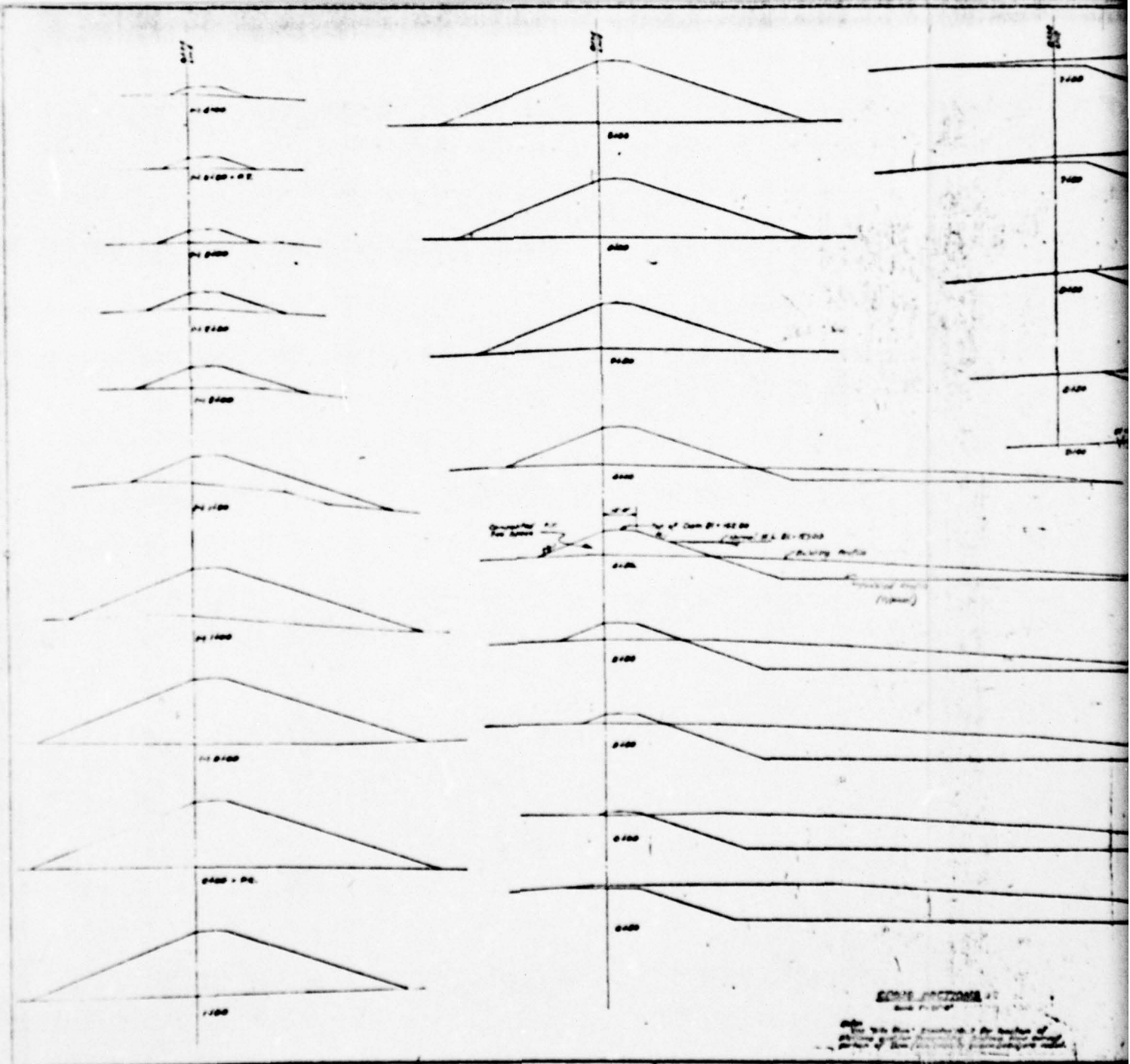


PLATE II

1

2



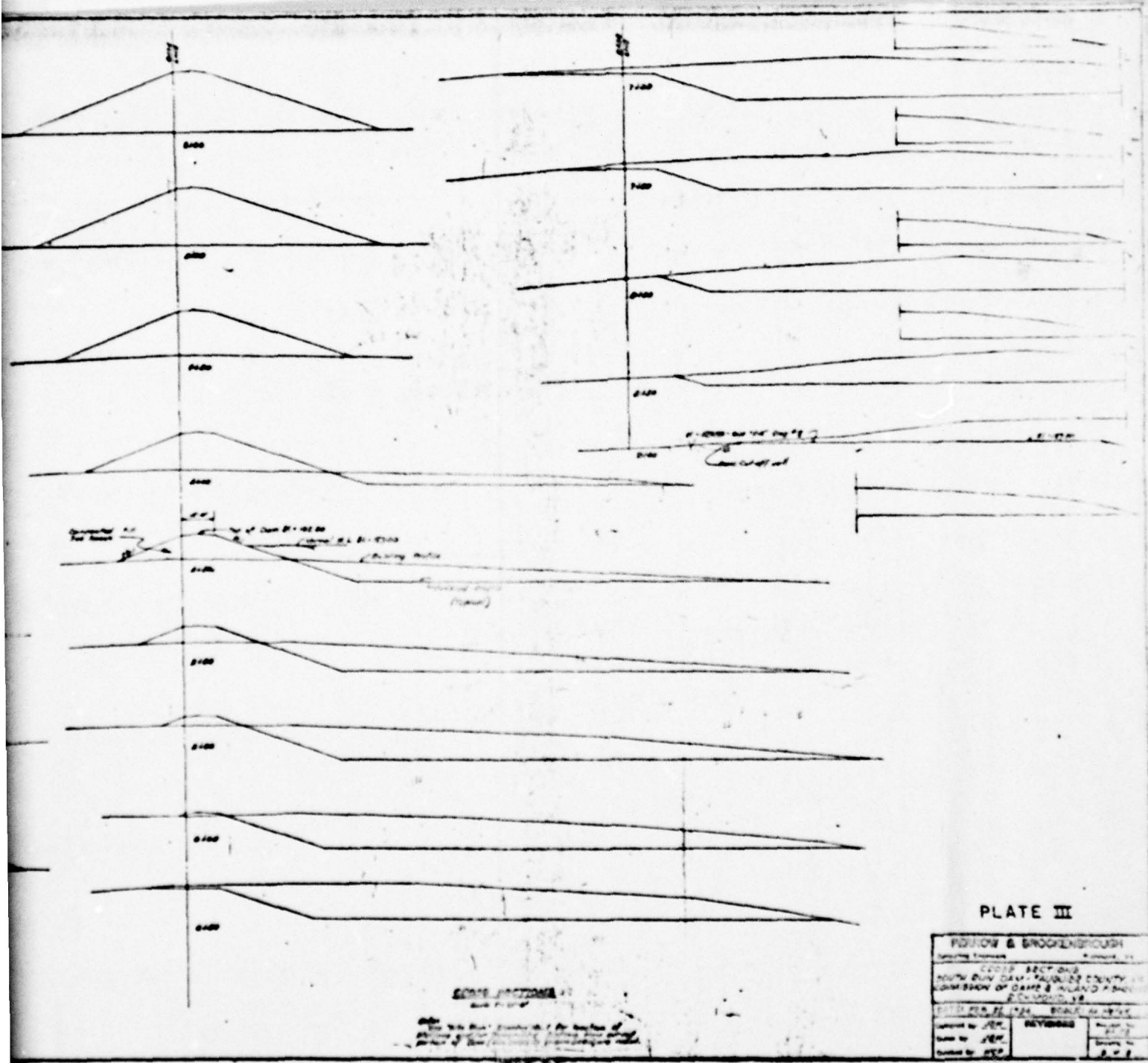


PLATE III

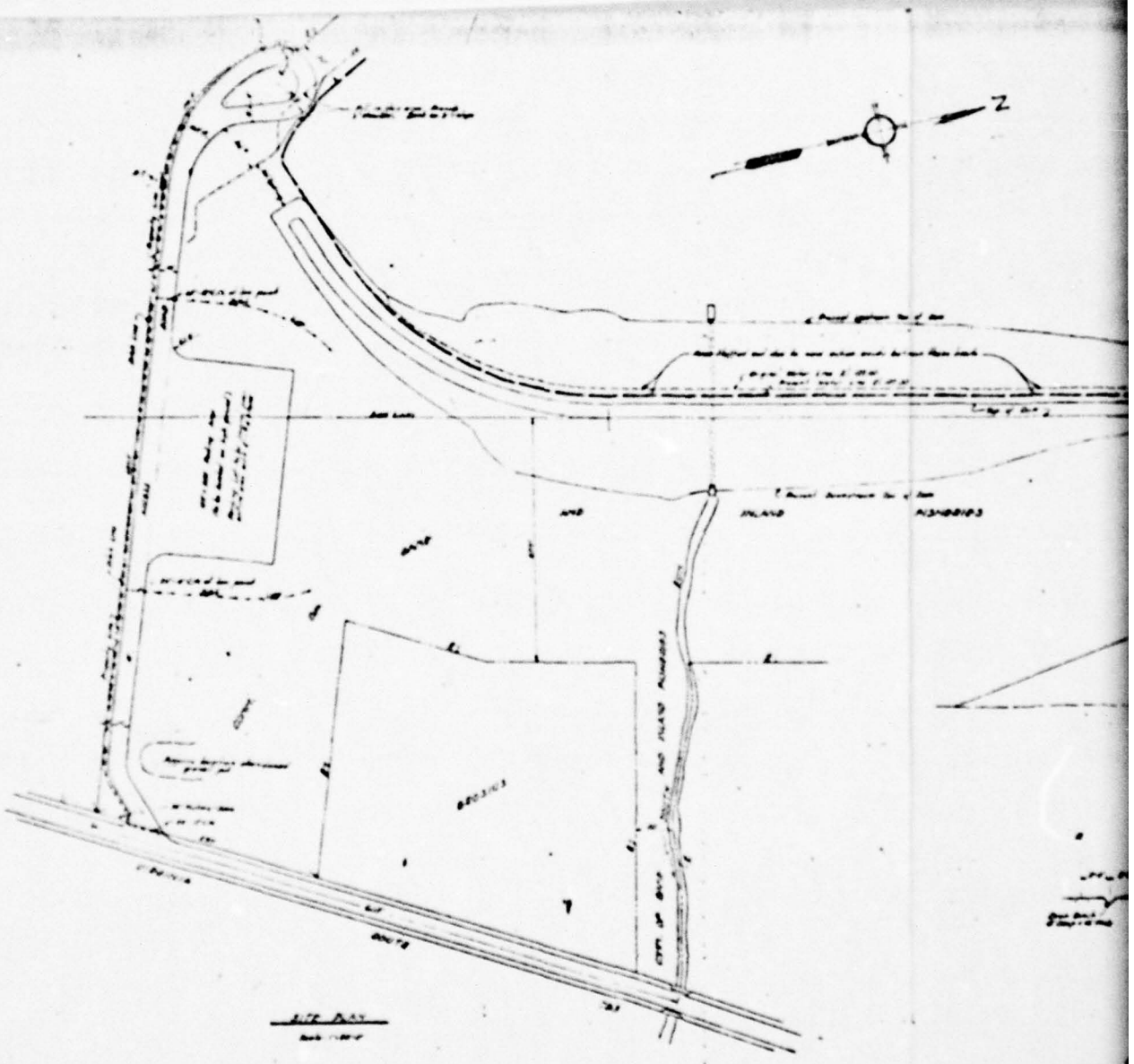
FOLLOW & BROOKENBROUGH

SOUTH RUN DAM - FAUQUIER COUNTY

REVISIONS

1

2



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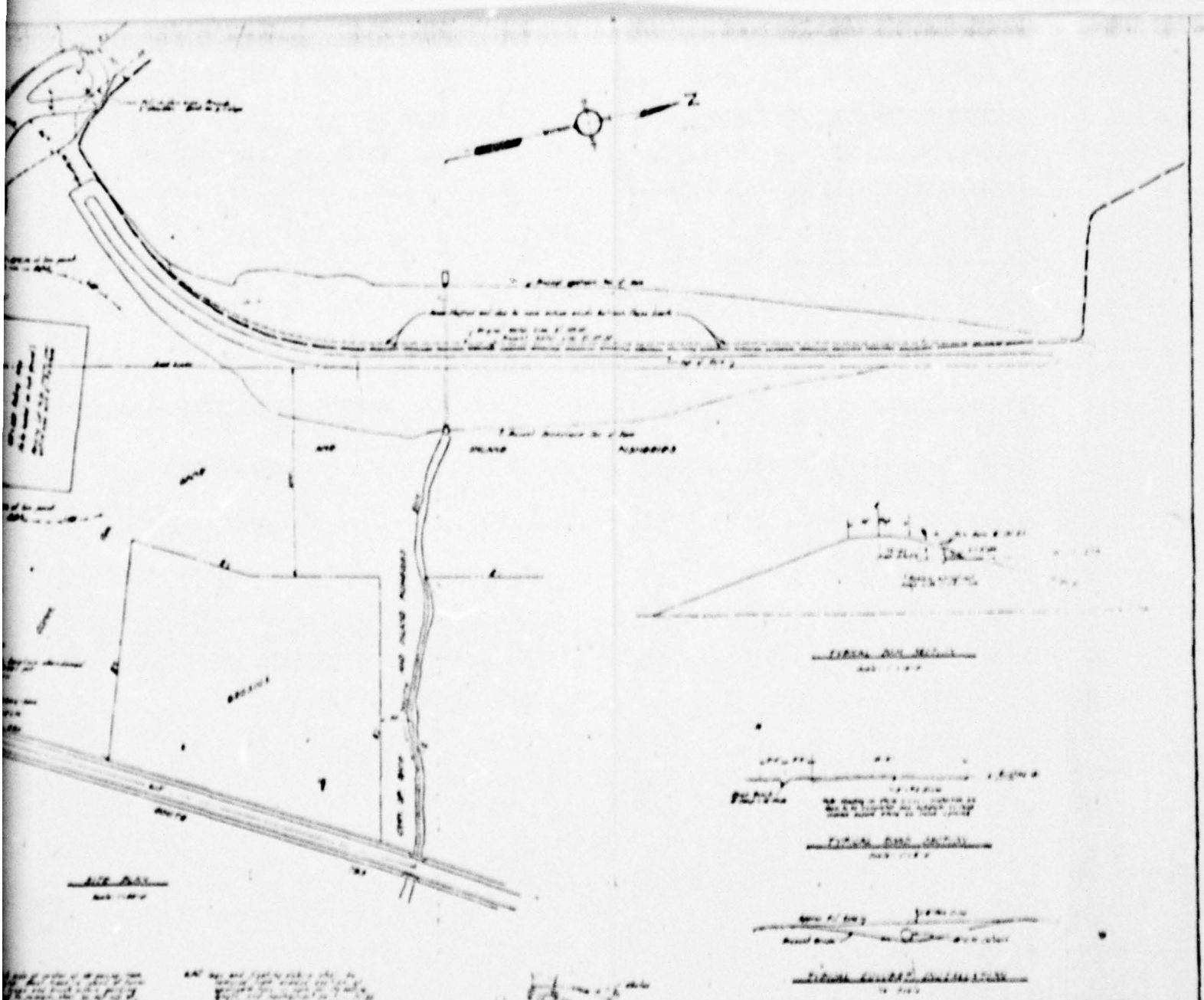

PLATE IV

APPENDIX II

PHOTOGRAPHS

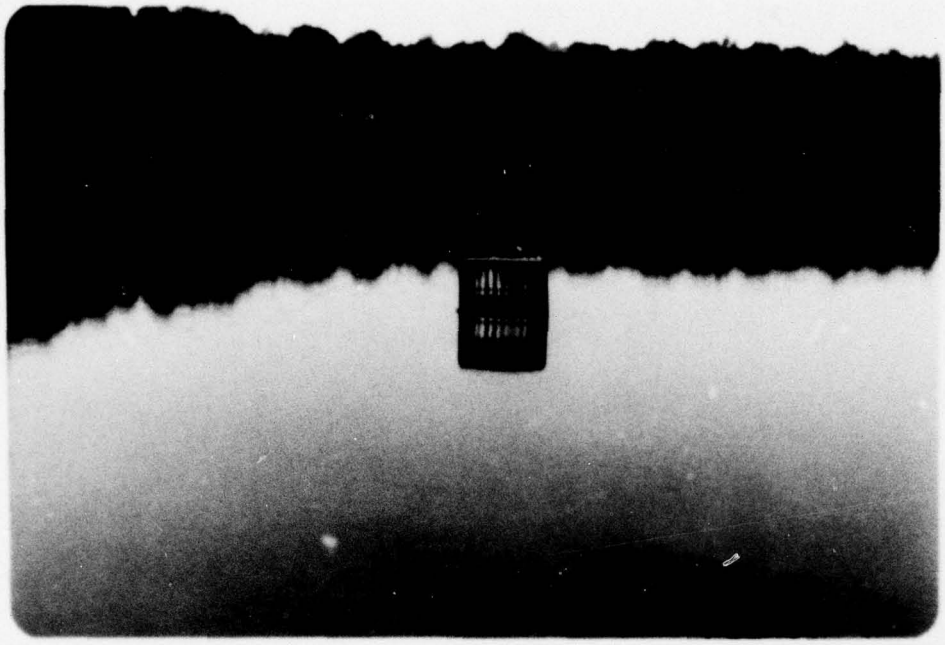

PHOTO #1 INTAKE STRUCTURE

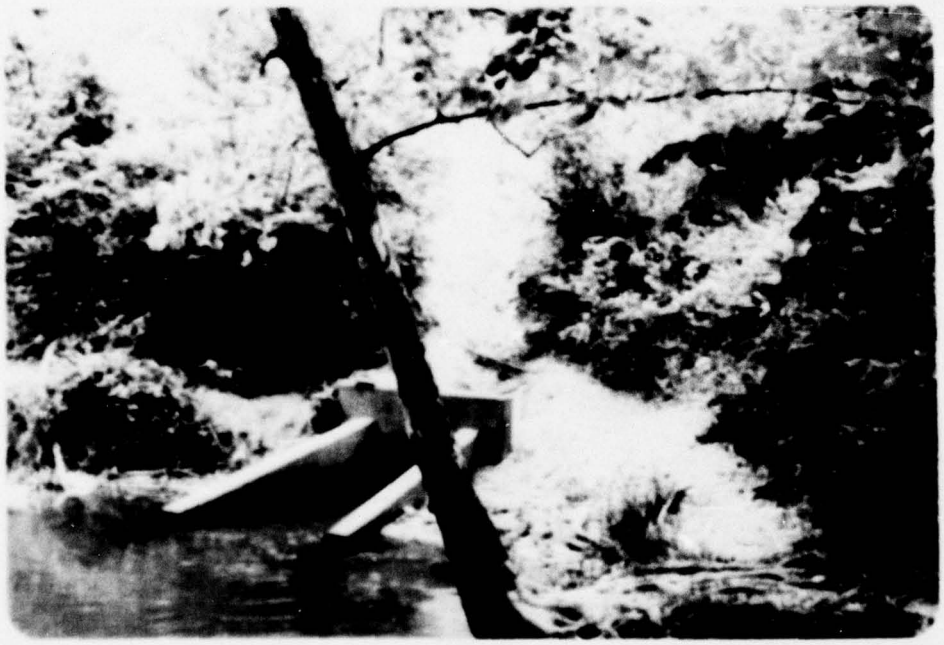

PHOTO #2 OUTLET STRUCTURE

PHOTO #3 DOWNSTREAM CHANNEL

PHOTO #4 TYPICAL OF EROSION ON DOWNSTREAM SLOPE

PHOTO #5 SEEP AT TOE OF DAM TO LEFT OF PRINCIPAL SPILLWAY

PHOTO #6 HEAVY VEGETATIVE GROWTH ON DOWNSTREAM SLOPE

PHOTO #7 EMERGENCY SPILLWAY

PHOTO #8 AUXILIARY SPILLWAY

APPENDIX III

FIELD OBSERVATIONS

Check List
Visual Inspection
Phase 1

Name Dam Lake Brittle County Fauquier State Virginia Coordinates Lat. 38° 44.9' Long. 77° 41.4'

Date(s) Inspection 31 May 1979 Weather Rainy Temperature 60°F

Pool Elevation at Time of Inspection 127 ± assumed datum Tailwater at Time of Inspection 100 ± assumed datum

Inspection Personnel:

J. Robinson, COE
L. Jones, COE
B. Taran, COE
D. Pezza, COE
R. Murphy, SWCB
J. Fouse, CGIF
Ed Steinkoenig, Va. Game Commission
John Banister (Resides at dam)

PEZZA & ROBINSON Recorders

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	No surface cracks were found. However, most of the downstream slope is heavily vegetated with brush and locust saplings. The vegetation inhibited the inspection.	The embankment should be completely stripped of brush and trees. Any subsequent holes should be dressed with compacted fill similar to the embankment material.
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	No unusual movement or cracking was found.	None.
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	No sloughing was found. Surficial erosion has exposed most of the downstream slope about 150 feet right of the outlet works. A footpath leads from the top of the dam to the outlet works. The upstream slope has little or no vegetative cover. It was noted that the upstream slope had been subjected to 3 to 4-foot drawdown from normal pool without any detrimental effect to the slope. The drawdown part of an operational procedure.	After stripping of brush and trees, exposed soil should be protected with a grass cover suitable for preventing surficial erosion. The foot path should be paved for the same reason.
VERTICAL AND HORIZONTAL	Alignments do not appear to deviate from the drawings.	None.
RIPRAP FAILURES	The upstream slope was protected with crushed shale riprap. The protection has deteriorated to the point that it serves no purpose.	Additional slope protection is not needed because of very little wave action and non-fluctuating pool levels. However, should slope erosion develop, immediate remedial measures should be undertaken.

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	No problems were encountered at the junctions.	None.
ANY NOTICEABLE SEEPAGE	Several wet spots with local ponding were found in the downstream area within 100 feet of of the embankment toe. A large linear wet spot was also located on the downstream slope about 125 feet right of the outlet works. These spots have been located on the drawings. The vegetation prevented a thorough investigation. A spring was located in the discharge channel of the emergency spillway.	The spots in the downstream area should be monitored during periodic inspections. If the waters should become muddy and levels suddenly change, immediate investigations should be undertaken by geotechnically trained personnel.
STAFF GAGE AND RECORDER	There are no gages or recorders on the embankment.	None.
DRAINS	The dam does not have a drainage system.	None.

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	No cracking or spalling was noted in the concrete outlet.	1/2 of the outlet pipe is submerged by stilling basin pool.
INTAKE STRUCTURE	No cracking or spalling of concrete was noted. The wooden flashboards that form the weir were in good condition (top 6 feet recently replaced).	None.
OUTLET STRUCTURE	Outlet pipe and wing wall appear in good condition. The outlet pipe is 1/2 submerged.	None.
OUTLET CHANNEL	Stilling basin was about 50 feet long, with small stones lining the pool.	None.
EMERGENCY GATE	There is no emergency gate.	Must remove all flashboards from normal pool level to drain the reservoir.

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	The weir is 300 feet long and 2 feet wide with an elevation approximating that of the approach and discharge channels.	None.
APPROACH CHANNEL	Flow occurs through the spillway about once a year. The approach channel is muddy with some areas void of vegetation.	Vegetate the bare spots.
DISCHARGE CHANNEL	Good vegetation at the beginning of the discharge channel, then thick trees that are below the entire embankment.	No need to cut trees, obstructed flow from dammed debris will be diverted away from the dam embankment.
BRIDGE AND PIERS	N/A	

EMERGENCY SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE SILL	N/A	
APPROACH CHANNEL	Flow occurs through the spillway about once a year. Some muddy areas were noted over the entire spillway with a grass cover that appears to have withstood past floods.	None.
DISCHARGE CHANNEL	A small erosion gully and muddy areas were noted in the upper portion of the discharge channel. Thick trees are in the lower portion of the channel.	Trees should be removed from the discharge channel. Obstructed flow by dammed debris can be diverted toward the dam embankment. Dress the gullies with compacted fill and vegetate with a grass cover.
BRIDGE AND PIERS	N/A	
GATES AND OPERATION EQUIPMENT	N/A	

INSTRUMENTATION

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	There are no monuments on the dam.	None.
OBSERVATION WELLS	No wells are on the dam.	None.
WEIRS	A concrete weir extends across the ungated spillway on the left side of the dam.	None.
PIEZOMETERS	There are no piezometers.	None.
OTHER	There are no staff gages.	A staff gage should be added to the intake structure and extend above the normal pool elevation.

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Mild slopes--1/2 pastures and 1/2 wooded. No erosion was noted.	None.
SEDIMENTATION	Unable to evaluate.	None.

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBSTRUCTIONS, DEBRIS, ETC.)	Thick tree growth in the channel and overbanks was noted for at least 1/4 mile.	Some trees should be removed and others thinned to allow ease of flow in case of a flood.
SLOPES	Mild slope with thick tree growth.	None.
APPROXIMATE NO. OF HOMES AND POPULATION	Portions of Vinton Hill Farms Station Military Reservation lie below the dam about 1/2 mile.	None.

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	As-built drawings are available showing the plan view of the dam.
REGIONAL VICINITY MAP	A map is shown on the as-built drawings.
CONSTRUCTION HISTORY	The only records available are the contract specifications.
TYPICAL SECTIONS OF DAM	Cross sections are shown on the as-built drawings.
HYDROLOGIC/HYDRAULIC DATA	No data are available.
OUTLETS - PLAN - DETAILS - CONSTRAINTS - DISCHARGE RATINGS	The as-built drawings show the plans and details. No discharge ratings or constraints are available.
RAINFALL/RESERVOIR RECORDS	Rainfall records are sent to the Division of Game and Inland Fisheries in Fredericksburg, Va.

ITEM	REMARKS
DESIGN REPORTS	No design reports are available. The design firm listed on the as-built drawings is Perrow & Brockenbrough, Richmond, Virginia.
GEOLOGY REPORTS	No reports are available.
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	No computations or studies are available.
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	Borings are referenced in the contract specifications, but there are no data available.
POST-CONSTRUCTION SURVEYS OF DAM	A dam inspection performed by Froehling and Robertson, Inc. in June 1972, and a report are available.
BORROW SOURCES	Borrow sources are referenced in the specifications and the general area is shown on the drawings.

ITEM	REMARKS
SPILLWAY - PLAN - SECTIONS - DETAILS	Sections and details are shown on the as-built drawings.
OPERATING EQUIPMENT PLANS & DETAILS	There is no operating equipment on the dam.
MONITORING SYSTEMS	There are several pins and bench marks in the area. A drawing is available showing their locations.
MODIFICATIONS	In 1955 an access road was constructed to the dam and the upstream slope was riprapped.
HIGH POOL RECORDS	Only record is the pool level noted during Tropical Storm Agnes. The level at that time was approximately 2 feet below the top of the dam.
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	No studies and reports have been made.
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	There are no known accidents or failures of the dam. The upstream slope was riprapped in 1955 to protect an eroded slope at the waterline.
MAINTENANCE OPERATION RECORDS	No periodic maintenance operation records have been kept.

APPENDIX IV

1972 INSPECTION REPORT

SINCE
1881

FROEHLING & ROBERTSON, INC.
INSPECTION ENGINEERS • CHEMISTS • BACTERIOLOGISTS
CABLE ADDRESS—"FROEHLING"

MAIN OFFICE AND LABORATORIES
P. O. BOX 27204, 814 WEST CARY STREET
RICHMOND, VIRGINIA 23261
PHONE 644-3251

BRANCH LABORATORIES
NORFOLK, CHARLOTTE, RALEIGH
WASHINGTON, BALTIMORE
GREENVILLE, ROANOKE, FAYETTEVILLE
ASHEVILLE

Richmond, Virginia
June 30, 1972

Commonwealth of Virginia
Commission of Game & Inland Fisheries
P. O. Box 11104
Richmond, Virginia 23230

Attn: Mr. Jack Hoffman

Ref: Inspection of Lake Brittle Dam
F&R Report #X-1992-6

Gentlemen:

Upon authorization of Mr. Jack Hoffman of Commission of Game & Inland Fisheries, the writer visited the Lake Brittle Dam for the purpose of inspecting the dam. This visual inspection was aimed at determining the general dam conditions, presence of piping, leakage through the dam and around the primary spillway, condition of primary and emergency spillway and abutments and any other conditions pertinent to the function and safety of the structure. This report is of necessity general and limited to a visual inspection, review of available drawings and information, and knowledge of the geological history of the area. This general inspection does not however guarantee the integrity of the dam.

PAST HISTORY AND DESIGN INFORMATION

Lake Brittle is located on the eastern edge of Fauquier County in a setting of gently rolling countryside surrounded mostly by hardwood timber. The dam, constructed prior to 1955, imponds an area of 77 acres.

GEOLOGY

Lake Brittle is formed along South Run about 1½ miles southeast of New Baltimore, Virginia and adjacent to Vint Hills Farm Station Military Reservation. The area is one of low, broad relief because the topography has been developed upon rocks of a Triassic basin lying east of Pond Mountain - Baldwin Ridge.

The Triassic formation has been identified by Roberts (1922) at the lake site as a two-fold one consisting of the Bull Run Shale and the Manassas sandstone which are irregularly interbedded. The Manassas sandstone is usually reddish and arkosic, and of varying induration. Bull Run Shales are more extensive and uniform than the sandstone but their color ranges from red through gray and blue to black. The shale disintegrates readily when weathered to form a fine silty soil.

INSPECTION AND OBSERVATIONS

The writer visited Lake Brittle on June 29, 1972 and inspected the dam and spillways by walking the crest and toe of the structure noting the following deficiencies which should be corrected:

(1) A moderately heavy stand of locust and other vegetation that should be removed. This growth obscures the surface of the dam and greatly impeded the visual inspection. Additionally, the developing root systems of the locust saplings could result in weakening the structure.

(2) The dam is infested with moles. The burrowing of these animals, while not extending as deep as the locust roots, is a potential problem as the burrows may afford a ready-made conduit which could be enlarged by seepage and pose a threat to the safety of the dam.

(3) The upstream face of the dam shows the development of a wave-cut bench with a shallow nipline extending the full width of the dam. The rock presently covering this area is apparently too small and ungraded to prevent wave erosion on the upstream face. Additional coarse riprap, equal or similar to Virginia Department of Highways dry riprap Class 1, should be added to the upstream face.

(4) Primary spillway should be cleared. The primary spillway is overgrown with hardwood saplings in the area down stream of the concrete curtain. These saplings trapped much debris during the high-water following tropical storm Agnes. The secondary spillway is clear and provided relief; however, the impediment to free flow which is created by the stand of saplings can only be considered detrimental to the integrity of the dam. Further, the tangle of brush and debris below the primary spillway should be cleared. A more ideal solution would be removal of trees along the lowest portion of the land slope below the primary spillway to provide a channel of free flow for water leaving the lake by means of the spillway.

CONCLUSIONS AND RECOMMENDATIONS

The visual inspection permitted by the heavy growth of vegetation, while admittedly cursory, revealed no cause to question the present safety of the dam. A more thorough visual inspection could have been made if the dam had been cleared of saplings, brush, tall grass, and weeds and maintained in that condition.

Areas of deficiencies which were noted are indicated under INSPECTION AND OBSERVATIONS along with some suggestions for remedy. Initiation of a program to remove trees from the dam and a periodic mowing in addition to an annual inspection by competent personnel will be beneficial to proper maintenance of the integrity and safety of the dam. Ideally the inspection should be made shortly after mowing.

We hope we have supplied the requested data. If you have any questions please feel free to contact the writer.

Very truly yours,

FROEHLING & ROBERTSON, INC.

W. H. DuHling, Jr.

WHD/dw

APPENDIX V

SPECIFICATIONS

SET NUMBER 7

SPECIFICATIONS

COVERING

EARTH FILL DAM AND CLEARING POND SITE

ON

SOUTH RUN

FAUQUIER COUNTY, VIRGINIA

* * * * * *

COMMONWEALTH OF VIRGINIA

COMMISSION OF GAME & INLAND FISHERIES

RICHMOND, VIRGINIA

I. T. QUINN, EXECUTIVE DIRECTOR

* * * * * *

FEBRUARY 22, 1954

* * * * * *

PERROW & BROCKENBROUGH

CONSULTING ENGINEERS

RICHMOND, VIRGINIA

SPECIFICATION NO. 54-05

SPECIFICATION

The site is located in Fauquier County, Virginia, on South Run with the dam located approximately 1,000 feet upstream from State Route 793, as indicated on the vicinity map. The nearest town is New Baltimore on Routes U. S. 29 and U. S. 211.

The dam may be reached on a State of Virginia owned right-of-way. The location of the dam and pond will be pointed out by Mr. Clay Brittle, Warrenton Supply Company, Warrenton, Virginia, or his representative. The Contractor desiring to look at the site and right-of-way shall make an appointment with Mr. Brittle or his representative.

The work shall consist of the installation of 163 linear feet of 36 inch reinforced concrete pipe with a concrete overflow box on the upstream end, and a concrete headwall on the downstream end; temporary diversion dam and channel change to divert the stream through this pipe during construction; the dewatering of the present stream bed during the construction of the dam and core wall; excavation for a core wall to solid material; the placing and compaction of a clay core wall to the original ground line; the placing and compaction of an earth-fill dam of suitable material of approximately 1,010 linear feet, including the removal of all top soil, sand, loam and unsuitable material; placing a cut-off wall of reed and concrete block in the upper part of the fill; construction of a spillway approximately 150 feet in length and placing concrete wall in spillway.

The Contractor shall remove all trees, brush, logs and debris in the inundated area of the pond to contour 127.0 and shall burn them or otherwise dispose of them in a manner approved by the Engineer. All stumps shall be cut off to within six inches of the ground, except that existing stumps may remain above the six inch cut-off, provided they do not extend above elevation 121.0. The original owner of the land has reserved the timber and is removing all merchantable timber in the pond area. He will be allowed to continue such removal until April 21, 1954. After this date, the merchantable timber may be removed by the Owner, provided it does not interfere with the construction, but the Contractor shall cooperate with the person removing the timber.

Place 4 inches of top soil removed from area covered by fill and borrow pit from water level on the upstream side of the dam to the toe of the dam on the downstream side and seed this area with grass seed, as called for in the specification.

Earth for making the dam fill shall be taken from borrow pits located adjacent to the dam.

SPECIFICATIONS

1. GENERAL:

The work covered by these specifications includes the furnishing of all labor, material and equipment, and the construction of an earth fill dam, including installation of outlet pipe with concrete overflow box, outlet headwall, cut-off wall, spillway, topsoil and seeding, and clearing inundated area of the pond, all to be in accordance with the accompanying drawings. The work is to be complete and ready for use.

The Contractor shall bid a lump sum amount in accordance with the Proposal Form for all work indicated on the plans and in accordance with the specifications.

2. PREPARATION OF SITE:

a. Clearing: All brush, trees, stumps and large roots shall be removed from the area to be covered by the earth fill and burned or otherwise disposed of. No brush, etc., removed in clearing operations shall be allowed to remain on the area to be inundated above the dam, or below the dam where they may be floated off by high water. Brush and stump grubs shall be burned. Trees, stumps, brush, etc., shall be removed from the area of the spillway and borrow pit and disposed of. All usable timber within the area to be cleared is being removed by others.

b. Removal of top soil: After clearing is complete, top soil shall be removed from the area to be covered by the earth fill to suitable clay or other approved materials. Suitable top soil from the dam site and the borrow pit shall be stock piled and used for top soil on completed dam.

c. Drainage and dewatering: The pipe culvert shall be installed as soon as possible with the overflow chamber, and headwall and diversion channels so that the present stream can be diverted through this pipe and the dam site be dewatered.

Adequate provision shall be made to dewater the foundation to permit the installation of the clay core wall. Such dewatering, and the maintenance of pumps and equipment that will permit the core wall to be constructed and compacted in the dry is a responsibility of the Contractor.

3. EXCAVATION:

The core wall shall be excavated to solid material or to the minimum depth as shown on Drawing No. 1, the width being twelve (12) feet at the bottom with sloping sides so that it is approximately sixteen (16) feet at the top. The excavation for dam fill shall be taken from the spillway areas or borrow pits to the north or south of the dam, as indicated on Drawing No. 1.

If ordered by the Engineer, core trench for the core wall shall be extended to a greater depth than shown on Drawing No. 1, and such excavation shall be paid for as indicated in the Special Provisions.

Excavation for outlet pipe shall be to the grades indicated and the lump sum price for this work shall include any rock which has to be removed.

Solid rock excavation if ordered removed by the Engineer for the core wall shall be paid for at the price indicated in the Special Provisions, which shall include necessary fill material.

All excavation from borrow pit and spillway shall conform with grades indicated. Berms shall be left on a smooth and uniform slope. Any excavated material not suitable for fill in the dam shall be disposed of on the site as directed.

4. FILL OR EMBANKMENT:

Earth used in making the embankment and core wall shall be clean clay, free from roots, top soil and other objectionable materials. It shall be taken from the spillway or borrow pit site indicated on the plans. The first layer deposited on area to be covered by fill shall be spread to a thickness of approximately 9 inches and rolled with a sheep-foot roller to penetrate into subgrade and form a bond between the two materials. Successive layers shall not be over 6 inches in thickness before compaction. Compaction shall be obtained by the use of a sheep-foot roller having a unit pressure of at least 200 pounds per square inch for that portion of the roller in contact with the completed fill or other approved rollers. It is the intent of these specifications to obtain a fill compacted to within 95% of the maximum density at optimum moisture content for the core wall and earth-fill dam. The Contractor shall therefore add moisture to or dry by aeration each layer as may be necessary to bring the soil to the optimum moisture content for compaction. The Contractor shall carry a slope from middle of the fill to the sides so that in case of rain the water will run off and not pond in the earth fill. If soft spots develop in the fill, they shall be removed or recompacted. The embankment shall be rolled with the sheep-foot roller until the required compaction is obtained. The use of frozen material will not be permitted and no fill shall be placed on frozen ground.

After the core wall is placed and before starting on the fill proper, the area to be covered by the embankment shall be carefully inspected for pockets of rock or other unstable foundation material. Any such material shall be removed by side casting or by forcing the unstable material beyond the side of the fill as the embankment material is deposited. Regardless of the method employed, all unsuitable materials shall be removed to the depth and extent necessary to secure a foundation that will safely support the fill to be placed and shall be paid for as shown in Item 3 of Proposal Form. No material shall be left in the foundation that will allow uneven settlement of the new fill.

However, material removed from the core wall may be placed on the downstream toe of the earth fill dam, as indicated. This material shall be placed as much as possible in layers and rolled over with a bulldozer and compacted.

5. CLEARING RESERVOIR AREA OF POND:

The Contractor shall remove all trees, brush, logs and debris in the inundated area of the pond to contour 127.0 and shall burn them or otherwise dispose of them in a manner approved by the Engineer. All stumps shall be cut off to within six inches of the ground, except that existing stumps may remain above the six inch cut-off, provided they do not extend above elevation 121.0. Care shall be taken in burning all brush, trees, logs and stumps so that fire will not spread to other areas and Contractor shall obtain permission or a permit from the local forester before any burning will be allowed.

All merchantable timber in being removed by the original owner, who will be allowed to continue such removal until April 21, 1954. After this date the merchantable timber may be removed by the owner, provided it does not interfere with the construction, but the Contractor shall cooperate with the person removing the timber.

6. CONCRETE:

The overflow box shall be Class A concrete and the collars and headwall shall be Class B concrete.

A. Materials: Concrete shall be composed of cement, fine aggregate, coarse aggregate and water so proportioned and mixed as to produce a plastic and workable mixture suitable to the specific conditions of placement.

The mix shall be designed to secure watertight concrete having the following compressive strength at the age of 28 days, as determined by breaking three standard 6-inch diameter by 12-inch high test cylinder specimens in accordance with procedure set forth in Specification A.S.T.M. Designation C31-38 and C39-38.

Class	Min. average for any 3 Consecutive Cylinders	Minimum for any one Cylinder
A	3,000 lbs. per sq. in.	2,500 lbs. per sq. in.
B	2,500 " " " "	2,000 " " " "

The cement factor shall not be less than 5.75 bags (94 lbs. per bag) for Class "A" concrete and not less than 4.75 bags for Class "B" concrete. In no case shall the total water content, including moisture in aggregate, exceed 6 gallons per sack of cement.

"Darex" or approved equal air entraining agent shall be added (approximately 25 C.C. per bag of cement) to produce an air content of 4% to 6%, in strict accordance with manufacturer's recommendations.

Cement shall be of any standard brand of PORTLAND CEMENT Type II, and shall comply with Federal Spec. SS-C-191D. Unless otherwise approved by the Engineer, only one brand of cement shall be used throughout the project. Certified reports of mill test of each shipment shall be furnished the Engineer in duplicate, if requested.

Coarse aggregate shall consist of crushed stone, or crushed or uncrushed gravel, having clean, hard and durable pieces free from injurious amounts of soft, friable,

thin or laminated pieces, organic or other deleterious matter. Aggregate shall be graded from coarse to fine within the following limits:

	Percent passing by weight
1" Square mesh screen - - - - - - - - - - - -	95 to 100
½" " " " - - - - - - - - - - - -	35 to 70
No. 4 Screen - - - - - - - - - - - - - - - - - -	0 to 10

Fine aggregate shall be clean, sharp, natural sand consisting of hard, strong, durable and uncoated particles graded as follows:

Total Passing	Percent by Weight
No. 4 sieve - - - - - - - - -	95 to 100
No. 16 " - - - - - - - - -	35 to 75
No. 50 " - - - - - - - - -	10 to 25
No. 100 " - - - - - - - - -	2 to 8

Sand shall contain not more than 1.0% of clay lumps by weight and not more than 3.0% shall be removed by decantation.

Water used in mixing concrete shall be clean and free of injurious amounts of oil, acids, alkali or organic matter.

B. Mixing and Placing Concrete: All concrete shall be machine mixed in batch mixers having regulating valves to control the amount of water to be added.

Provision shall be made for measuring by weight all aggregates used in the concrete. The concrete shall be mixed in such quantities as required for immediate use, and shall be placed while fresh and before initial set has occurred. Each batch shall be held in the mixer, with the drum rotating at recommended speed, for not less than 1½ minutes after all material, including water, are in the drum, before beginning the discharge.

Concrete in the overflow box shall be constructed monolithically or with the construction joints, as indicated on the plans. Where construction joints are used, a key way shall be placed with a 20-gage galvanized iron or copper dam, as indicated, and a grout mixture of one-part cement and two-parts sand shall be placed a depth of approximately 2" over the surface of the joint immediately preceding the pouring of concrete.

The mixed concrete shall be deposited in uniform layers to prevent segregation. It shall not be dropped in bulk with a vertical free fall over 5 feet. Mechanical vibrators, as approved by the Engineer, shall be used to work the concrete into corners of forms and around the reinforcing.

Concrete placed in cold weather shall be protected against freezing in a manner approved by the Engineer. If required, all aggregates, including water, shall be heated. No frozen lumps shall be permitted in the aggregate before mixing and the reinforcing shall be free of ice or frost when the concrete is placed. Admixtures to prevent freezing will not be allowed.

C. Curing and Finishing: All concrete shall be kept wet by sprinkling with water for a period of five (5) days after placing, or by covering with an approved water-saturated covering. Any method used shall keep the surface continually wet.

All exposed concrete and wall surfaces to a depth of 6 inches below finished grade shall receive a wood float finish, except floors in buildings which shall be troweled smooth by steel trowel. All slabs shall be floated smooth and finished without the addition of dry mix or additional mortar. Bulges in surfaces caused by give in forms shall be rubbed down to the plane of adjacent surfaces rather than by filling depressed surfaces with mortar to a true plane.

D. Forms: Forms shall be made of selected material, clear and free from loose knots and similar defects, and so erected as to conform exactly when filled with concrete to the dimensions of the structure or member as shown on the plans. Forms for all exposed surfaces shall prevent loss of grout and be of uniform thickness. The proper forming of concrete work shall be entirely the responsibility of the Contractor. Where metal ties are used to hold the forms in place, such ties shall be cut off a minimum depth of one inch from the face of concrete after forms are removed, and the holes left properly filled with cement mortar. All corners and angles not otherwise detailed shall have chamfer strips 1/2" x 1/2" measured on the right angle legs.

Forms shall be thoroughly wet, or oiled as approved by the Engineer before placing concrete. Forms shall not be removed from walls for a period of less than two days, nor from slabs for a period less than 14 days without approval of the Engineer.

E. Reinforcing: All reinforcing rods shall be of new billet steel, deformed and conforming to A.S.T.M. Spec. Designation A-305-50T, or to Fed. Spec. QQ-B-71a. Wire mesh shall conform to A.S.T.M. Designation A-185-37. All reinforcing shall be, when surrounded by concrete, securely wired in place and entirely free from loose scale, rust, or other coating which might destroy or reduce its bond with concrete. Shop drawings and bending details shall be furnished by the Contractor, in triplicate, for Engineer's approval, before fabricating.

Protective covering on steel unless otherwise shown shall be 1½" in floor beams and walls, and 3/4" in slabs.

7. [illegible]:

A barrier wall shall be constructed in the center of the fill from Elevation 122.00 to Elevation 129.00 as shown on the plan and shall be continuous across the dam from original soil on north side to original soil on the southeast side. It shall consist of five feet of timber barrier and 2 feet of 4 inch concrete block. The purpose of the barrier is to prevent damage to the earth fill by burrowing rodents. The timber portion of the barrier shall be of 2 inch sound local lumber placed on edge, random lengths and secured in place by 1 inch thick stobs driven into the completed fill at about 6 feet intervals. Lumber in each respective row shall be the same width. Knot holes or cracks between boards wider than 1/2 inch will not be permitted. Toe-nailing shall be employed if necessary to secure the boards in position and alignment. This wood portion of the barrier wall shall be five feet high from Elevation 122.00 to Elevation 127.00 as indicated.

The concrete block section of the barrier wall shall be made of 4" concrete or cinder blocks 8" deep and may be second blocks or chipped, provided that after being laid there shall be no opening through wall greater than 1/2 inch. Blocks shall be laid on edge and will not be mortared.

The barrier of wood plank and concrete block shall be built up as the fill progresses, and the sheep-foot roller passed as close to each side of the boards as possible to assure compaction. Not more than one layer of boards or block shall project above the completed fill at any one time. If the roller cannot get close enough to the wall to compact the fill, then it shall be hand tamped along the wall to obtain compaction.

8. CONCRETE PIPE:

Pipe shall be 36" Diam. Extra Strength Reinforced Concrete Culvert Pipe and shall comply with Specification A.S.T.M. Designation C76-41 table II and shall be a minimum of six feet in length. Pipe shall be as manufactured by the Concrete Pipe and Products Company, Richmond, Virginia, or equal.

The pipe shall be laid to a true line and grade in the best workmanlike manner. It shall have a complete bearing on solid or compacted earth for its full length and it shall not bear directly on any rock. The minimum clearance between the pipe and any rock shall be 3". Joints shall be made of a rubber gasket Tylox Joint or equal and placed in accordance with the manufacturer's direction. After this joint has been made, the opening left in the inside and outside shall be filled with a 1:2 cement-sand mortar. After pipe has been laid, earth shall be hand tamped around and under the pipe and, as the fill is raised, it shall be hand tamped around the pipe to a point where the sheep-foot roller can pass over the pipe without damage thereto.

Around pipe on the upstream side there shall be placed five cut-off concrete collars as shown on the plan. The concrete in collars shall be Class B.

9. MISCELLANEOUS IRON:

Angles shall be placed in slots for splash boards as shown on the plan. These shall be placed before concrete is poured so they will be securely attached to the concrete, and shall be placed vertical and perpendicular to inside face of concrete.

Screens shall be made of 3/4" steel bars welded to plates, as shown, and attached to the overflow box so they can be removed, as indicated.

All exposed screens and exposed leg of angle for splash boards shall be painted with two coats of aluminum paint, Sherwin Williams or approved equal.

10. SPILLWAY:

The spillway shall be graded as indicated and a Class B concrete wall shall be poured into a trench excavated into original ground. Concrete shall be poured against side of original earth and no forms will be allowed. The Contractor will be permitted to place 1/2 to 1 cu. ft. stones fully embedded in this wall.

The emergency spillway southwest of the dam shall not be grouted, but shall be to the original ground.

11. RIPRAP:

Riprap of 1/2 to 2 cu. ft. in volume stones shall be placed at the outlet end of the concrete headwall and at the south and north end of dam, as indicated. Riprap shall be hand placed to minimize the percentage of voids.

Stones for riprap are to be taken from boulders on the site, or may be obtained from local quarries at the Contractor's expense.

12. SPLASH BOARDS:

The Overflow Box requires two rows of splash boards, which may be removed to allow the water level to be lowered in the pond. The Splash Boards shall be of dense select structural timber, free of knots or shakes, shall be dressed on 4 edges and with straight contact edges. The Contractor shall be very careful to see that contact edges are straight and are placed so there shall be a very small amount of leakage, if any. If this condition is not met, the Contractor will have to remove and replace the boards.

Boards shall be 4" x 8" or 4" x 10", as available, cut to 3'-7" in length and shall not be less than 4" thick when dressed.

Install boards and secure in place by wooden wedges as directed, immediately before filling pond.

13. TOP SOIL:

After the earth fills are completed and sloped as shown on the plans, the top soil from the area covered by the fill, borrow pit and other areas in the vicinity, if required, shall be spread even over the area from water level on the upstream face to the toe of fill on the downstream face to a depth of 4 inches. No handraking or grading will be required, however, the finished surface shall be sloped as smooth as practicable by bulldozer or blade grader.

14. SEEDING:

After the top soil has been placed, grass seed shall be sown over the area from water level on the upstream face to the toe of slope on the downstream face at the rate of 5 lbs. per 1,000 sq. ft. of area, by hand or approved seeding equipment. The seed shall be as follows:

Common Name	Proportion by weight	Purity	Germination
Bermuda	30%	95	85
Tall Fescue	20%	95	85
Perennial Rye	30%	95	85
Red Top	15%	90	85
White Dutch Clover	5%	95	85
	100%		

The grass seed shall be mixed and guaranteed by the dealer to conform with the above requirements.

After the grass seed has been sown, the Contractor shall water the entire area with a fine spray and shall one week later, unless sufficient rains have occurred, water the area for the second time with a fine spray.

15. CLEAN-UP:

At the completion of the work, and before final acceptance by the Owner, the Contractor shall make a thorough inspection of the project and correct all work found to be faulty. Waste excavation and excavation removed for concrete foundations shall be leveled off, the banks of the borrow pit shall be sloped, as indicated, and the entire site left with a neat appearance, satisfactory to the Engineer.

16. GUARANTEE:

All phases of the work shall be completed in a first class workmanlike manner and the Contractor shall guarantee the work as to faulty workmanship or materials for a period of one year after acceptance by the Owner.

If, during the 12 month period following acceptance by the Owner, any defects caused by faulty workmanship or materials and/or negligence or lack of proper care on the part of the Contractor should be found, the Contractor shall furnish and install such new materials as are necessary and repair such defective work at his own expense, upon receipt of written notice from the Engineer or Owner.

APPENDIX VI

REFERENCES

APPENDIX VI

REFERENCES

1. "Recommended Guidelines for Safety Inspecttion of Dams," Department of the Army, Office of the Chief of Engineers, Washington, DC.

2. HEC-1DB Flood Hydrograph Package, (Hydrologic Engineering Center, U.S. Army Corps of Engineers, July 1978).

3. "Seasonal Variation of the Probable Maximum Precipitation East of the 105th Meridian," Hydrometeorological Report No. 33, (U.S. Weather Bureau, April 1956).

APPENDIX VII

LETTER FROM COMMISSION OF
GAME AND INLAND FISHERIES

(Hrg. EWCR)

COMMONWEALTH of VIRGINIA

COMMISSION OF GAME AND INLAND FISHERIES
Box 11104
Richmond, 23230

JAMES F. McINTEER JR. EXECUTIVE DIRECTOR
4010 WEST BROAD STREET
BOX 11104
RICHMOND 23230

August 24, 1979

Mr. R. V. Davis
Executive Secretary
State Water Control Board
P. O. Box 11143
Richmond, VA 23230

Dear Mr. Davis:

Our staff has reviewed the preliminary Phase I Inspection Report for Lake Brittle Dam and are in concurrence with the findings. We are currently making efforts to secure funds to perform the work indicated.

Sincerely,

James F. McInteer, Jr.
Executive Director

LGH/sk
cc: Mr. J. W. Engle, Jr.
Lands and Engineering Division